6.—FOSSIL SPONGES OF WESTERN AUSTRALIA

By

M. W. de LAUBENFELS,

Professor of Zoology, Oregon State College.

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INTRODUCTION.

In 1947, Professor E. de C. Clarke of the University of Western Australia, sent me a collection of fossil Porifera. They are of Miocene antiquity, from the Plantagenet Series (Albany, Cape Riche, and Norseman Beds) which occurs on or near the south coast of Australia only about 200 miles from its extreme west end. We have also for consideration two previous papers concerning fossil sponges from the same series : one by G. J. Hinde (1910) and the other by Chapman and Crespin (1934).

The delay in reporting requires explanation. It happens that a number of leading paleontological societies have begun cooperation leading toward an extensive, several-volume "Treatise on Invertebrate Paleontology." Although the bulk of my research has been on living sponges, its editors asked me to monograph the fossil sponges for this treatise. It seemed advisable to do that first, so that the research pertinent to it could then be applied to study of the Australian specimens.

The fossils which we have for consideration all seem to have been in a substratum of silt. This is slightly ferruginous, but more than ninety percent siliceous. It consists of fine grains, principally less than one micron in diameter, very loosely conjoined if at all. Most of the grains are amorphous, but a notable part of them are whole or broken sponge spicules. It is clear that the stratum was laid down adjacent to a region in which sponges throve. As pointed out in various of my papers, for example, that on Bermuda, sponges today reach maximum abundance in estuaries, just far enough out at sea for complete oceanic salinity to be established. Obviously it is river-borne material that encourages Porifera, the details being still unknown. It is furthermore evident that at the distance from the river where sponges thrive, the coarser debris will have been dropped, but not the finer silt, so that the latter accumulates around the Porifera.

We may therefore conclude that the region under consideration was (when our fossils were living organisms), just off shore from a river—the bigger the river, the farther off shore. All the fossil sponges are lithistids, which would seem to indicate a depth of 20 to 200 meters.

The fossils which we have for consideration are densely packed full of silt just like that of the country rock—pink and crumbling, and full of sponge spicules. This complicates identification. The fossil is a sponge, and full of sponge spicules, but because exactly such spicules permeate the surrounding material, most of those which happen to lie inside the boundaries of the fossil

are certainly foreign to it—perhaps all are—and yet those proper to it may be mingled with the foreign ones. How can one discriminate ? Only the conjoined skeletal elements (the desmas) are certainly proper.

The Lithistida still live, and from study of living forms we conclude that the group is polyphyletic. Nevertheless, it is so distinctive, and convenient in paleontological study, that for the latter it should be treated as an order of the class Demospongea of the phylum Porifera. Today lithistids are rare as compared to other sponges, and probably this has always been more or less true, but because of their coherant framework their likelihood of successful fossilization is disproportionately great. Therefore they are outstandingly important in the paleontology of Porifera.

The Lithistida have long been grouped into sub-orders, according to the type of skeletal element present, these elements being called desmas. From time to time a few fossils have been found whose desmas were difficult to allocate, being somewhat intermediate between the sorts typical of the sub-orders. Other unusual situations involve fossil sponges having desmas in one place characteristic of one suborder, but elsewhere having desmas characteristic of another suborder. Our Plantagenet fossils possess both of these ambiguities to a distressing extent. We may also recall the abundant presence of obviously foreign sponge elements in them.

Nearly all fossil lithistids have conspicuous cloacas, although sponges in other orders often lack such cavities. Much of the classification of lithistids has therefore been based on the size and shape of the cloaca. Our Plantagenet fossils are notably lacking in cloacal cavities ; this is yet another item which adds perplexity.

In other respects, the fossils under consideration are suitable for study. They have been very little weathered, or crushed, or metamorphosed. They have been skillfully removed from their placements, well-packed and otherwise cared for.

We may first describe a collection of fossils from a place 20 miles south of Ravensthorpe, to the west of the Eyre Range. This would be near the coast, and west of Hopetoun.

The types are preserved at Geology Dept. University of Western Australia.

DESCRIPTION OF SPECIES.

Phylum PORIFERA

Class DEMOSPONGEA

Order LITHISTIDA

Suborder RHIZOCLADINA

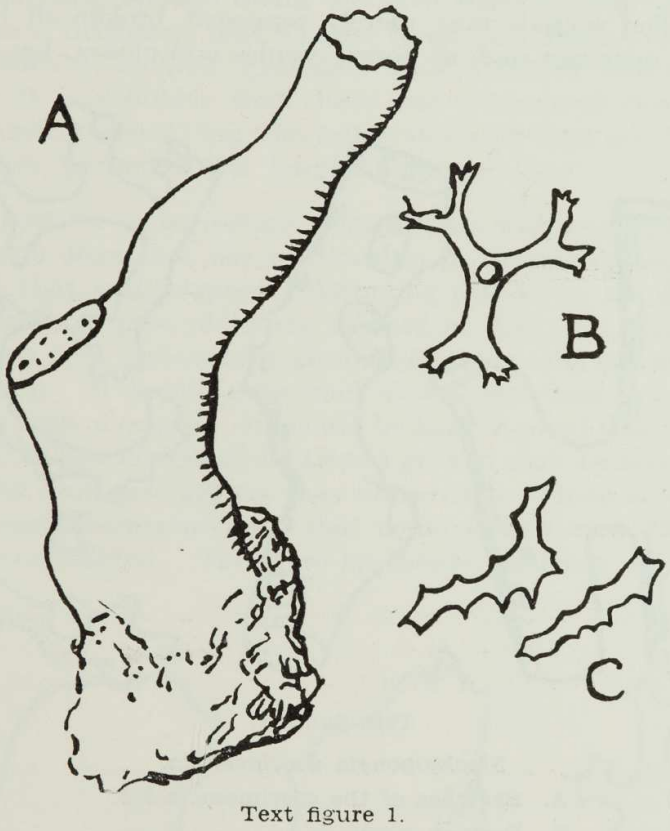
Family **KALIAPSIDAE**

Genus **CORALLISTES** Schmidt 1870, p. 22

Corallistes australis new species.

Specimen number 23735. This is a twice bent lumpy cylinder, which had been branched, and a second fragment, a truncated cone, that probably had been connected. The diameters range from 1·5 to 3 cm. The over all

length of the larger piece is 11 cm. Much of the surface retains the well preserved, dense, lipostomous dermis, even the fine wrinkles in it being still visible. Unfortunately there has been complete or almost complete loss of all evidence as to pores, oscules, and cloaca if (as is probable) there had been a cloaca. In the interior traces of canals can be found, in spite of the dense packing of silt. These that have been observed are about 1 mm. in diameter, and are perpendicular both to the surface and to the longitudinal axis of the sponge. There may have been a long, narrow cloaca following the course of the longitudinal axis.



Text figure 1.

A. Sketch of the sponge, x 5/6.
B. Cladome of a dermal triaene, x 80.
C. Fragments of desma skeleton, x 100.

The skeleton of the endosome is a reticulation of desmas, very firmly cemented together. Only fragments of them could be detached for microscopic study. They are rather more like rhizoclad desmas, but enough like tetraclad desmas to render identification perplexing. The dermis, less than 100 microns thick, is finer grained than the endosome. In many places only the slightly smaller desmas could be located. In a few places it was possible to see the heads or cladomes of triaenes, whose long, straight fourth ray or rhabd penetrated into the interior, perpendicular to the surface. Each of the three clads were dichotomously branched, as is commonplace, but were further again branched at the tips into several crooked fine brachlets.

The cladome shape, and the ramose form of the shape, are distinctive.

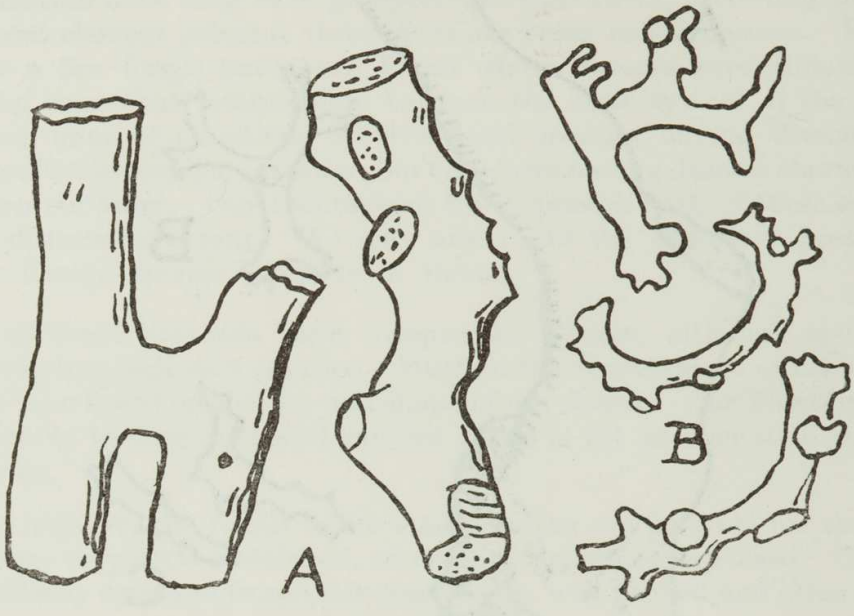
Corallistes is chiefly a recent genus, but is has also been found throughout the Cenozoic, world wide.

Family SCYTALIIDAE

Genus STACHYSPONGIA. Zittel 1878, p. 129

Stachyspongia neoclavellata (Chapman and Crespin).

Specimen number 23732. This comprises two fragments of a ramose sponge. One fragment is simple, the other is " H " shaped. The diameter is about 1 cm. and the length about 6 cm. The nearly straight specimen shows a number of wounds, which may have been places where branches emerged, but is is also beset with large, low conules, nearly 1 cm. in diameter, 3 mm. high. The wounds may merely represent broken-off higher conules. Evidence as to openings such as pores, oscules and cloaca, has been lost.



Text figure 2.

Stachyspongia neoclavellata.

A. Sketches of the specimens, x 5/6.

B. Desmas, x 100.

The certainly proper skeleton consists only of conjoined desmas. These are here regarded as rhizoclad, but attention is called to the fact that they are not typical, but exhibit some of the features of tetraclad desmas.

Chapman and Crespin on pages 115 and 116, describe specimens as *Thamnospongia neoclavellata* and *Thamnospongia subglabra*. The genus *Thamnospongia* Hinde is tetraclad, with especially tuberculate endosomal desmas, and with distinctive phyllotriaenes in the ectosome. Neither of these features is described by the authors. The two species are illustrated by their plate IX, figures 16, 17 and 18. All three of these photographs closely resemble specimens number 23732. The descriptions on pages 115 and 116 will also fit the present specimens. The opinion is therefore here ventured, that we have for consideration a single species, *neoclavellata*. It best fits Zittel's genus *Stachyspongia*, although not typical of that, nor of any other existing generic description.

Stachyspongia has hitherto been recorded only from the upper Cretaceous of Europe.

Genus **ZOSTEROSPONGIA** new.

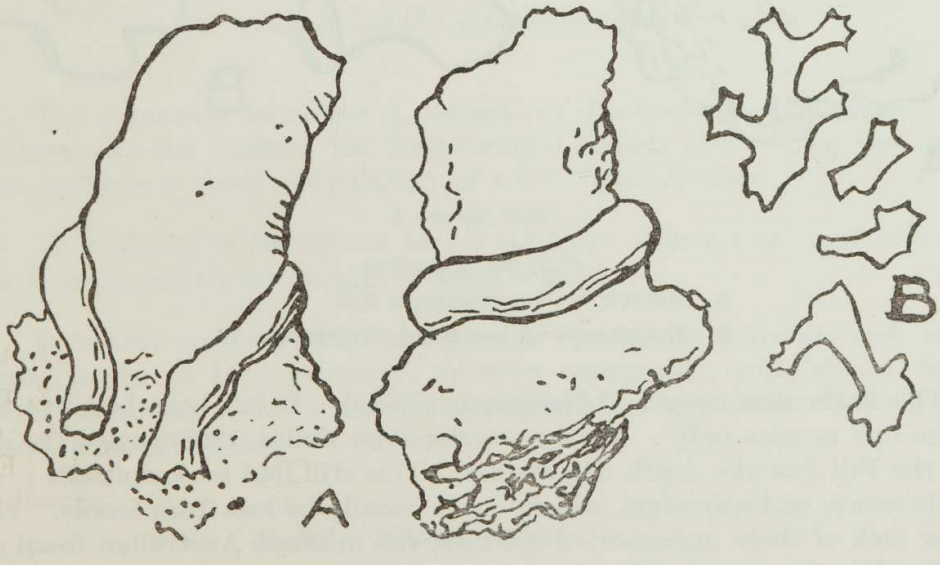
This genus is here established in the family Scytaliidae for an elongate cylindrical lithistid sponge which grew in a most unique manner around another sponge, constricting it. The type and only species is the following :—

Zosterospongia thaumasta new species.

Specimen number 23841 B. The constricted sponge (to be discussed further later), is here designated as 23841 A.

The constricting sponge seems to have been circular in cross section. It is 5 to 7 mm. diameter, and 85 mm. long. Its surface is a fine-grained, hard dermis, with no evident openings. It is wrinkled, and the wrinkles are longitudinal. It is probable that there was a terminal oscule and a small longitudinal central cloaca, but the latter squeezed shut by the post mortem shrinkage which produced the longitudinal wrinkles.

It is not possible to be certain what was up with regard to gravity when the sponges were alive, but the relationship to the matrix strongly indicates the placement that is illustrated. Assuming this to be the case, the sponge now being described grew obliquely upward at first, but clung to the other sponge. It then grew horizontally around the other side, still closely appressed to its companion. It finally grew back down, and thus came within 6 mm. of touching its base of origin. It should be kept in mind that lithistid sponges are very rigid. Their course of continued growth may be steered by environmental agencies, but once grown, they are brittle. There is not the slightest trace of any environemental force that could have forced 23841 B to grow in this circuitous fashion. Therefore an innate tendency so to grow is here presumed.



Text figure 3.

Zosterospongia thaumasta.

A. Front and back views of the two sponges, x 5/6.

B. Desma fragment, x 100.

The ectosome is a dense mass of conjoined desmas. The endosome is only slightly less dense. The elements of the skeleton are so firmly united that only fragments can be detached for study. These are rhizoclad, but not typical, as in the preceding genus.

Comment may be made, that in the study of living sponges, we find that when two of the same species adjoin intimately, they regularly anastomose. Obviously the two sponges here described were of different species.

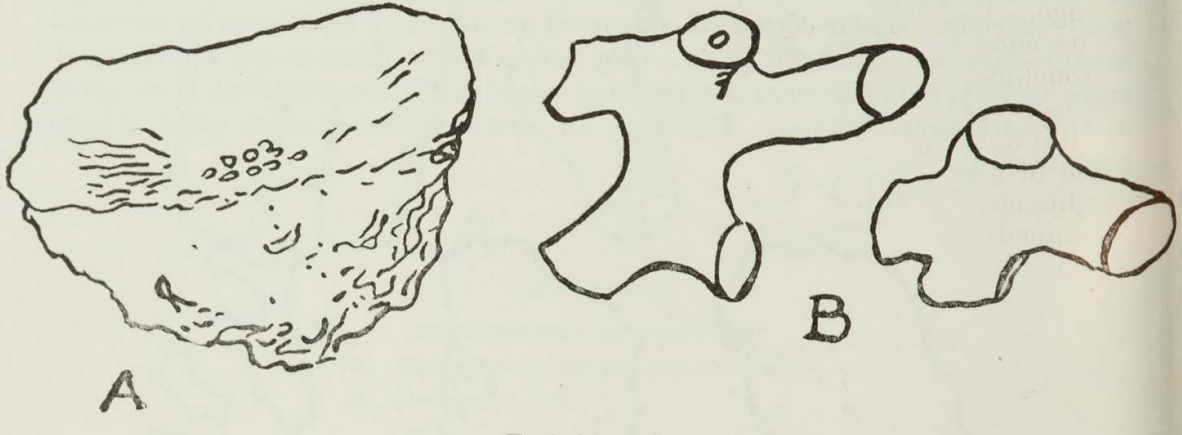
Suborder MEGACLADINA

Family **PLEROMIDAE**

Genus **PLEROMA** Sollas. 1888, p. 312.

Pleroma miocenea new species.

Specimen number 23846 A. This is perhaps to be called hemispherical. The upper surface is shallow concave, and fairly regular, but the lower (very convex) surface is extremely lumpy and irregular. The top is 4 by 6 cm. The height is 4 cm. The convex surface is finely porous, probably representing the physiological pores. The exhalent openings on the top are chiefly within a 1 cm. circle in its centre, and each of a dozen or so is nearly 1 mm. diameter. There is some confusion with cavities that may have been carved by environmental agencies during fossilization. No special dermal skeleton is to be found. The skeleton is a rigid conjoined structure of megaclad desmas, their shafts 100 to 150 microns in diameter.



Text figure 4.

Pleroma miocenea.

A. Sketch of the sponge, x 5/6.

B. Fragments of megaclad skeleton, x 70.

This is the first record of *Pleroma* as a fossil. It has been hitherto known for the one species only : *Pleroma turbinatum* Sollas 1888 page 312, recent, from the Fiji Islands, depth 576 metres. This still had loose spicules : oxeas, dichotriaenes, and spirasters, which would usually be lost from fossils. Except for the lack of these uncemented spicules, the miocene Australian fossil agrees closely with the recent *Pleroma*.

Chapman and Crespin, page 115, describe a fossil as *Thecosiphonia lobosa*, new. Their photograph of it (Plate IX., figure 15) reveals a sponge much like 23846 A. They say of it " Dermal layer consisting of small clasping rhabdocrepid desma, as in the living *Pleroma*." This does not describe either *Pleroma* or 23846 A, nor does their description of the endosome. None the less, one must consider a possibility that *miocenea* might fall in synonymy to *lobosa*.

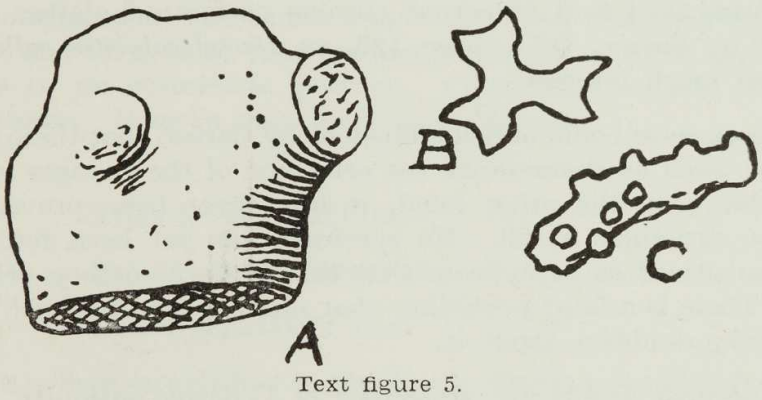
Suborder TETRACLADINA

Family **PLINTHOSELLIDAE**

Genus **PHYMAPLECTIA** Hinde 1884, p. 87.

Phymaplectia sterea new species.

Specimen number 23848. This specimen may have been incipiently ramose, but as found is a palmate slab with two or three mammiform projections. One of the projections may be the base of a branch that has been broken off. The dimensions are 2 by 3 by 5 cm., the projections 1 cm. diameter, 1 cm. high. The surface in general is finely porous, probably due to the actual or physiological pores. One or two surface dimples may represent closed oscules.



Text figure 5.

Phymaplectia sterea.

A. Sketch of the specimen, x 5/6.

B. Head or cladome of the dermal triaene, x 100.

C. Fragment of the endosomal skeleton, x 200.

The ectosome comprises a palisade of diochotriaenes, of course with the cladomes at the surface, the long straight rhabds penetrating the endosome. The latter is a stout reticulation of tuberculate desmas.

This species is distinctive for its solidity. Many species of *Phymaplectia* are thinner-walled, even cup or vase shaped.

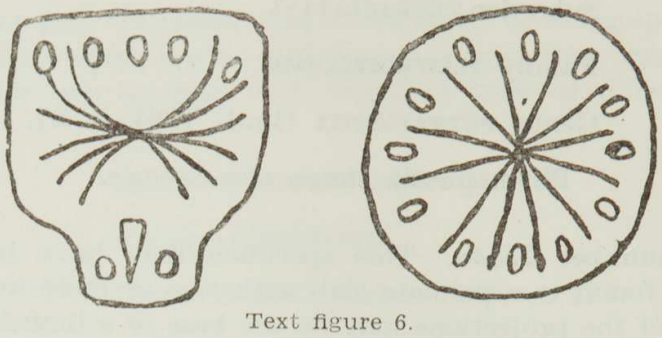
It is here surmised that many other specimens in the present collection, would prove to be congeneric, or even conspecific, with *sterea*, were they better preserved. This is especially suggested for specimens numbers 23849 A, 23840, and 23841 A.

Family **DISCODERMIDAE**

Genus **DACTYLOCALYCITES** Carter, 1871, p. 123.

Dactylocalyx callodiscus Carter.

Specimen number 23843. This is a clavate fossil, about 3 cm. in diameter and 8 cm. high. It has a conspicuous dermis, much wrinkled, but pores and oscules cannot be determined. This dermis is all or chiefly a solid mass of desma reticulation. The endosome is somewhat coarser, very brittle.



Text figure 6.

Dactylocalyx callodiscus.
Two of the peculiar perforated silica plates (x 100).

The mass of this sponge contains the usual quota of obviously foreign spicules, chiefly fragmentary, and both in quantity and in variety like the content of the country rock, but with this exception : In this specimen, and only inside it, I find numerous curious perforated plates. These were first named by Carter, 1871, page 123, as *Dactylocalycites callodiscus*, and have aroused much interest.

It has been most commonly assumed, as by Carter, that these are modified discotriaenes, such as characterize the ectosome of the sponges of the family Discodermidae. On the other hand, it has never been proven that they were sponge structures at all. No specimen has yet been found in which they were so placed as to indicate that this was where they originated and belonged. There is a faint possibility that number 23843 is such a specimen, but I am very doubtful about it.

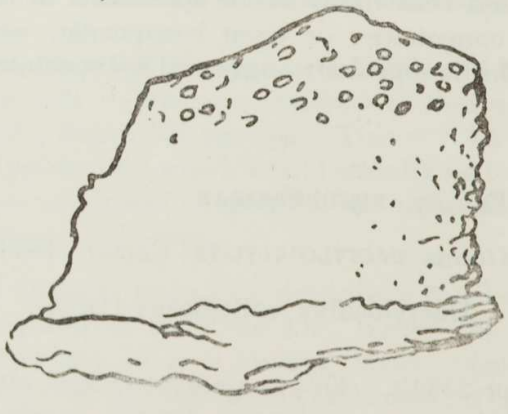
These peculiar fossils are altogether of Cenozoic antiquity, not Recent, and are especially common in Australia and New Zealand.

Family uncertain

Genus **TRAGALIMUS** Pomel., 1872, p. 202.

Tragalimus amechanus new species.

Specimen number 23840. This is a somewhat acorn-shaped object, 6 by 6 by 6 cm. The most nearly flat side, corresponding to the cup of the acorn, appears to have been covered with a smooth but wrinkled dermis. The rest of the surface is granular, and porous, with pores (or oscules !) about 1 mm. diameter and 2 mm. apart, on centres.



Text figure 7.

Tragalimus amechanus.
Sketch of the specimen, x 2/3.

It is by no means certain that this is all one species ; the top may be one sponge and the bottom another, but the appearance is remarkably like that illustrated by Courtiller, 1861, page 7, for his *Dimorpha balanus*, which is the type of the genus *Tragalimus*.

Neither Pomel nor Courtiller, nor anyone else, has adequately described details of the skeleton of this genus, and therefore its allocation has always been problematical. We are not able to help much now. The whole skeleton is lithistid, but that is the best one can say. Bits taken from various parts of the fossil, and studied microscopically, appear most contradictory. In places the desmas appear to be rhizoclad, but in more places they seem definitely tetraclad. In some places they are lumpy, as in *Phymaplectia*, but mostly they are not. In one place I found numerous phyllotriaenes, but such spicules normally form a dermal or subdermal layer, and nowhere on this fossil could I find them so located.

We may conclude that this is indeed the sort of fossil described by Courtiller and by Pomel, and for a third time confess perplexity as to its skeletal type, and hence, as to its systematic position. Courtiller's records were upper Cretaceous, France. Pomel's may have been Miocene.

Suborder EUTAXICLADINA

Family **ASTYLOSPONGIIDAE**

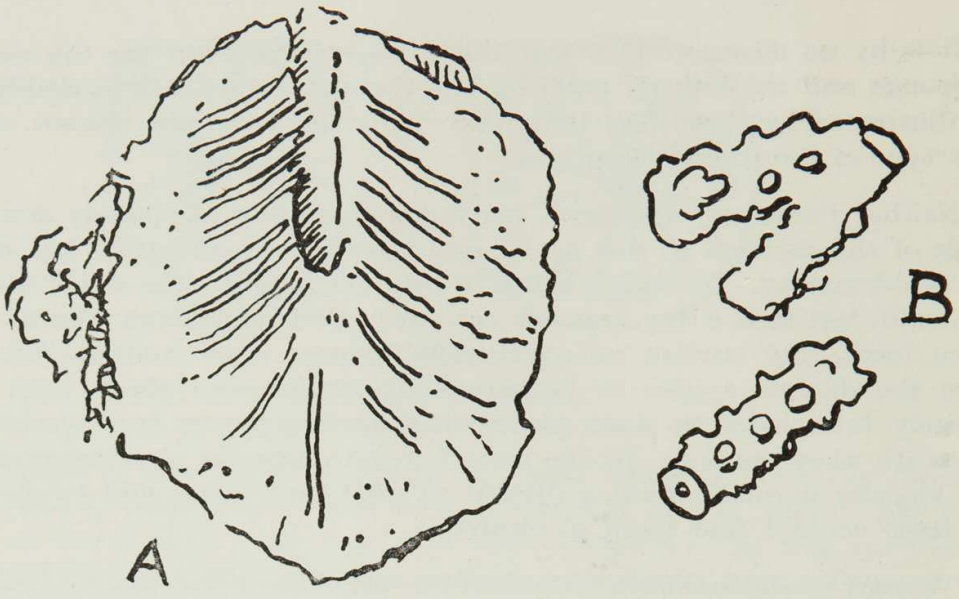
Genus **NEDLANDSIA** new.

This genus is here established in the family Astylospongiidae for a rather poorly preserved fossil which appears to be much like the paleozoic genus *Caryospongia*, but is Tertiary in age. Pending further discovery of related but better preserved specimens from its vicinity, this genus must be regarded as provisional, certainly subject to revision. The type is the one species, *clarkei*.

Nedlandsia clarkei new species.

Specimen number 23846B. This reveals a subglobular sponge which had been 5 to 6 cm. in diameter. It had evidently been exposed and half of it weathered away, revealing a vertical section through its centre. There is visible that which appears to have been a central cloaca, 3 mm. diameter, and 3 cm. deep. What appear to be exhalent canals (apochetes) come to it in great numbers, their diameters about 1 mm., and at 1 cm. from it they are less than 3 mm. apart on centres. They make a radiating pattern. Very few of them flow together.

The skeleton of this sponge either was very flimsy in life, or else has been reduced to this condition during fossilization. In a broken surface, with oblique illumination, it can be ascertained that the pattern as described does have a three dimensional nature. It is most evident on the weathered surface, where the locations of the lithistid skeleton have been slightly less easily eroded than the silt-packed canals. What fragments of skeleton could be found are very tuberculate. This is true of some tetraclad lithistids, significantly including the genus *Phymaplectia*, which occurs near where specimen number 23846B was found. It is also true of the dicranoclone desmas of the suborder Eutaxicladina. I was not able to ascertain whether or not the spicules of 23486B were dicranoclones.



Text figure 8.

Nedlandsia clarkei.
A. Sketch of the specimen, x 5/6.
B. Fragments of the desmas, x 120.

Fossil sponges are often found of Paleozoic antiquity, which as specimens resemble number 23846B in pattern, and in ambiguity. Such are commonest in the Silurian, but are found also in the Ordovician. The similar but often rather well-preserved genus *Microspongia* (incorrectly called *Hindia*) is abundant beginning in the Ordovician and continuing through the Permian. The related *Neohindia* of the upper Cretaceous of Germany is the only Mesozoic specimen hitherto assigned to this group.

The species name is given in recognition of the distinguished paleontologist E. de C. Clarke.

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Professor Clarke also collected a remarkable specimen from the Plantagenet series, at a locality four miles north-north-east of the Kalgan River, on the road from Albany to Gnowangerup. It is composed of silt particles which are almost entirely siliceous, plus very abundant sponge spicules and especially spicule fragments, but these are arranged in a curiously symmetrical pattern.

At the centre is a plug, about 2 cm. in diameter, of blue-green material, probably coloured by ferrous iron whereas the ochraceous larger portion is tinted by ferric iron. There may have been considerable organic matter in the plug, reducing the iron as it decayed. This plug is now chiefly sponge spicular debris, but of such diversity that many species are certainly represented. This plug may have been a sponge with incoherent skeleton, but if so, it cannot now be determined which of the spicules were proper to it. Some recent Porifera secrete no spicules of their own, but pick up foreign spicules of many varieties, depending upon what other sponges occur in the vicinity. The plug may have been such a sponge.

Except on its exposed circular surface, this plug is encased in a wall about 1 mm. thick, very hard, made of spicule fragments inorganically cemented together. There are recent sponges whose proper spicules anastomose, but none in which foreign spicules are conjoined by inorganic means. Those that depend upon foreign spicules lack ability to deposit silica. Around this wall, the silt has been deposited in concentric layers, each layer a cone,

until an inverted cone has been built up, at least 8 cm. in diameter at the top, with a present altitude in its truncated condition, of 7 cm. Around this there had been, and unless weathered or broken off there still is another indurated layer, cone shaped, 1 mm. thick, made of inorganically cemented sponge spicule fragments. Around the outside of this once more occur the larger and larger cones of the concentrically deposited silt plus spicules. This is puzzling.

The whole structure looks like drip stone, but the non-crystalline structure even more than the non-calcareous nature precludes this. It looks like a concretion, but again the microscopic structure rules that out. The layers precisely resemble those that would be quite commonplace if horizontal ; they look like layers of silt deposited by gravity—but they are conical in form ! Were the layers built up from the outside in, or from the inside out ? Apparently twice during their formation, the deposition was almost exclusively of spicule fragments, and at this time silica was also depositing out of solution, but not at other times.

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One who has made extensive study of recent sponges, as well as some study of fossils, may be able to add useful data to papers by paleontologists who have not studied recent Porifera so extensively.

We may thus consider the paper by G. J. Hinde, 1910. In this he describes and figures many sponge spicules, proving conclusively that nearly all the modern orders and families of Demospongia were represented in the Tertiary of West Australia. But he also attempts to assign some spicules to genera.

Prior to 1814, practically all animals which were recognised as being sponges were put in the one genus *Spongia*. Thus generic allocation seemed very easy then. As late as 1860 there were only a few score sponge genera, and they almost corresponded to the present concept of families in their all-inclusive nature. Now we have more than 1,400 genera of recent sponges, and more than 1,200 fossil sponge genera.

Thus when Hinde describes a fossil spicule and adds that " similar spicules occur in the recent genus *Craniella* " he is correct, but has not made an identification, because some fifty other genera also contain exactly the same sort of skeletal element. No genera can be regarded as conclusively identified in Hinde's paper, and only a very few are even " probably " identified.

This sort of difficulty evidently bothered to an especially large degree the efforts of Chapman and Crespin in their 1934 discussion of fossil sponges of West Australia. They were obviously also confused by the fact that authors such as Bowerbank (who certainly influenced his countryman Hinde) used a bewildering variety of names for sponge skeletal elements. In addition to the very excusable errors thus introduced in their paper, one may add with regret that they do not figure even so much as sketches of the skeletal structures of their specimens. Thus it is regrettably the case that most of their identifications fall short of being satisfactory.

An analysis of their descriptions may be given, as follows :—

On page 109 *Tethya* is identified from " globostellate " spicules. This was Bowerbank's term for spherasters. These also characterize other genera, especially *Chondrilla*, which is about as abundant as *Tethya*, or more so. *Latrunculia* is identified from " chessman " spicules. These occur in other

genera, such as *Podospongia* and *Sigmosceptrella*. *Halichondria* is identified from acanthoxeas, but these never occur in *Halichondria*. They do occur in about fifty or a hundred other genera in various families and orders.

On page 110 *Petrosia* is identified from " fusiform acerate spicules " which is Bowerbank's term for oxeas. Oxeas do occur in *Petrosia*, along with other sorts, but they also occur in some five hundred genera ; probably sixty per cent. of all living sponge individuals possess oxeas. *Desmacidon* is also identified from oxeas. One might as well " identify " some particular sort of passerine bird as the result of the discovery of " a feather." *Forcepia* is identified on the basis of forceps spicule, but these occur also in half a dozen other genera, such as *Forcepina*. *Strongylophora* is identified from the occurrence of strongyles. These occur in more than one hundred genera. *Craniella* is identified from protriaenes. Such spicules occur in every genus of the order Choristida, about fifty in all. *Stelletta* is identified from orthotriaenes. These are rare in *Stelletta* but occur in many other genera.

This is to say that isolated sponge spicules of the common sorts are utterly worthless for generic identification, or family identification, and only occasionally even for identification as to what order of Porifera they represent.

Page 111, a fossil is identified as of the genus *Ecionema*, excellently. Another is thought to be *Erylus*, but it is much more like *Geodia*. Another is called a *Caminus*, but it cannot possibly be of that genus, which has a cortex of sterrasters, and no " knobby forms." The specimen probably represents a new genus of the lithistid family Kaliapsidae, but it is inadequately known.

Page 112 began with another specimen called *Caminus* which cannot possibly be of that genus. The same remarks apply to it as to the preceding specimen. Next one is called a *Cydonium*, but so little of it is known that it could be any member of the whole order Choristida. Then one is called *Cydonium ramuliferum*. *Cydonium* is a junior synonym of *Geodia*, and *ramuliferum* is certainly not of this genus. The specimen is unidentifiable. *Theonella* is identified on the basis of spicules which are not characteristic of that genus. *Discodermia* is mentioned at the bottom of the page, and further on the following one.

Page 113 treats three species called *Discodermia*. This genus is characterised by a surface armour of discotriaenes, and no indication is offered that the specimens in question had such. In fact, their surfaces are so described as to make it clear that they did not. The descriptions are complicated by the perplexing use of terms, strongyles being spoken of as having clads, which they emphatically do not, hence one is unable to know what is meant by the author's use of terms in general.

Page 114 begins with another so-called *Discodermia*, which is also unrecognisable, but certainly not in the right genus. Then a very interesting fossil is called *Neosiphonia fungiformis*. It should not be identified with the recent genus *Neosiphonia* because it does not have the spicules which characterise that genus. Its desmas are not described. Perhaps they were as obscure as those in the collection made by Professor Clarke ; if so, the specimens in question would be difficult to place as to sub-order. If they were not obscure, and were figured or described, then this sponge might be allocated as it now can not.

Page 115 includes *Neosiphonia glauerti* which not only can not be a *Neosiphonia*, but—to judge from the description—is of the order Choristida rather than Lithistida. A specimen is called *Thecosiphonia lobosa*, but is described as though it belonged in the suborder Megacladina, not in the Tetracladina with *Thecosiphonia*.

Page 116 includes a species put in *Ragadinia*, but this genus has a dermal armour of phyllotriaenes. Two more generic names, *Corallistes* and *Vetulina*, are hazarded on the basis of individual spicules which are so generalised and commonplace that they are not useful.

Page 117 begins with an encrusting sponge called *Platychonia*, but this genus is for sponges that were erect, lamellate and bifacial. Then another is indentified as *Verruculina*, apparently quite correctly. At the bottom of the page, spicules are presumed to have been of *Rossella* and *Dactylocalyx*, but are very different from those found in such genera. In fact, not even the order of Porifera represented by these spicules can be determined.

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